REMARKS

Claims 1-24 remain pending in the application. The specification and claims 10, 13, 20 and 24 have been amended to place the application in better condition for examination.

Favorable consideration of the application is respectfully requested.

Respectfully submitted,

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<u>Mark-up of Specification</u>

Paragraph beginning on Page 6, line 27 and ending on Page 7, line 2

In the interference canceller units ICU_1-ICU_K of the second stage, the same procedures as in the interference canceller units ICU_1-ICU_K of the first stage are performed aside from the fact that the residual signal $r_2^{(1)}$ is used instead of the received signal $r_1^{(1)}$, and they respectively output replica signals $d_2^{(1)}$-$d_2^{(K)}$ of the second stage to the interference canceller units [ICU_3-ICU_K] <u>ICU_1-ICU_K</u> of the third stage. At the same time, they output residual signals with their own replica signals subtracted to the next interference canceller units.

Paragraph beginning at Page 7, line 25

The difference between the interference canceller unit shown in fig. 4 and the interference canceller unit shown in Fig. 2 is that the new replica signal d_{s+1}^k is resubtracted from the results of the above-mentioned addition of the residual signal r_{s+1}^k and the replica signal d_s^k to produce [an error] <u>a residual</u> signal r_{s+1}^{k+1}, and sent to the interference cancellation unit ICU_{K+1} corresponding to the next user.

Paragraph beginning at Page 15, line 9

The present invention also proposes a first interference canceller unit which is an interference canceller unit in a subtractive interference canceller for digital radio communications wherein the communication channel is composed of pilot bits, other control bits and data bits; characterized by comprising

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adding means [(300, 400)] (901) for receiving and adding an interference cancellation residual signal and a replica signal from a previous stage;

despreading means [(302, 402)] (905) for despreading the aforementioned addition signal by multiplying a spreading code of the user;

correcting means [(301, 303, 401, 403)] (903, 906) for determining a fading vector and performing transmission path correction;

tentative decision means [(304,404)] (707) for deciding on a symbol from the transmission path corrected signal;

weighting means [(308, 408)] (908) for multiplying a weighting coefficient to the tentative decision symbol;

spreading means [(305, 405)] (909) for respreading the tentative decision symbol by multiplying the spreading code of the user; and

decorrecting means [(307, 407)] (911) for determining a replica signal by multiplying [the inverse of] the transmission path properties to the respread signal; and

in that said weighting means outputs a weighting coefficient $\lambda_A{}^Q$ of the pilots bits, a weighting coefficient $\lambda_B{}^Q$ of the other control bits and a weighting coefficient λ^I of the data bits as separately derived values.

Paragraph beginning on Page 16, line 19 and ending on Page 17, line 7

The present invention also proposes a fourth interference canceller unit which is an interference canceller unit in a subtractive interference canceller for digital radio communications; characterized by comprising

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adding means [(300, 400)] (901) for receiving and adding an interference cancellation residual signal and a replica signal from a previous stage;

despreading means [(302, 402)] (905) for despreading the aforementioned addition signal by multiplying a spreading code of the user;

correcting means [(301, 303, 401, 403)] (903, 906) for determining a fading vector and performing transmission path correction;

tentative decision means [(304, 404)] (707) for deciding on a symbol from the transmission path corrected signal;

weighting means [(308, 408)] (908) for multiplying a weighting coefficient to the tentative decision symbol;

spreading means [(305, 405)] (909) for respreading the tentative decision symbol by multiplying the spreading code of the user; and

decorrecting means [(307,407)] (911) for determining a replica signal by multiplying [the inverse of] the transmission path properties to the respread signal; and

in that said weighting means determines a complex weighting coefficient such as to minimize the power of the interference cancellation residual signal for each channel in each stage.

Paragraph beginning at Page 23, line 9

Herebelow, a W-CDMA uplink shall be taken as an example for describing the operating principles of the weighting coefficient determining method based on the second aspect of the present invention. The communication data structure and modulation

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explained below is based on the 3GPP standard (see 3GPP, "Physical Channels and Mapping of Transport Channel onto Physical Channels [(DD)] (FDD)", *TS 25.211 v2.1.0,* 1999-6).

Paragraph beginning at Page 23, line 15

First, the received signal r(t) can, in general, be expressed as follows:

[Eq. 21]

$$r(t) = \sum_{i=1}^{N} \sum_{k=1}^{K} \sum_{l=1}^{L} h_{k,l}(t) c_k(t-\tau_{k,l}) b_{k,l,i}(t) + n(t)$$

$$b_{k,l,i}(t) = \begin{cases} a_{k,i} & iT_b \le t-\tau_{k,l} < (i+1)T_b \\ 0 & others \end{cases}$$

Here, N denotes the number of symbols, K denotes the number of users, L denotes the total number of paths, $h_{k,l}(t)$ denotes the [first] l-th channel coefficient of the k-th user, $c_k(t)$ denotes the spreading code, $b_{k,l,i}(t)$ denotes a rectangular pulse indicating the symbol duration relating to the i-th symbol $a_{k,i}$ of the k-th user, T_b denotes the duration of one symbol, [$\tau_{k,1}$] $\tau_{k,l}$ denotes the [first] l-th channel delay of the k-th user and n(t) is Gaussian white noise which is to be added. In the present specification, the parallel IC (PIC) or serial IC (SIC) is assumed to be provided at the base station (BS).

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Paragraph beginning on Page 25, line 23 and ending on Page 26, line 5

Therefore, the weighting coefficient which minimizes the expected value $I_{k,1}^{S}$ of the evaluation function can be expressed as follows.

[Eq. 29]

$$\left[\lambda_{k,l}^{s} = \frac{\int dh_{k,l}\int dH_{k,l}^{s}\int db_{k}\int dB_{k}^{s} H_{k,l}^{s}{}^{*} b_{k} B_{k}^{s}{}^{*}\ f(h_{k,l},H_{k,l}^{s},b_{k},B_{k}^{s})}{\int dh_{k,l}\int dH_{k,l}^{s}\int db_{k}\int dB_{k}^{s} \left|H_{k,l}^{s}B_{k}^{s}\right|^{2} f(h_{k,l},H_{k,l}^{s},b_{k},B_{k}^{s})}\right]$$

$$\underline{\lambda_{k,l}^{s} = \frac{\int dh_{k,l}\int dH_{k,l}^{s}\int db_{k}\int dB_{k}^{s} h_{k,l} H_{k,l}^{s}{}^{*} b_{k} B_{k}^{s}{}^{*}\ f(h_{k,l},H_{k,l}^{s},b_{k},B_{k}^{s})}{\int dh_{k,l}\int dH_{k,l}^{s}\int db_{k}\int dB_{k}^{s} \left|H_{k,l}^{s}B_{k}^{s}\right|^{2} f(h_{k,l},H_{k,l}^{s},b_{k},B_{k}^{s})}}$$

In particular, given the estimated channel $H_{k,1}^{S}$ and the tentative decision B_{k}^{S}, Equation 29 can be modified to the following equation.

[Eq. 30]

$$\lambda_{k,l}^{s}(H_{k,l}^{s},B_{k}^{s}) = \frac{\int dh_{k,l}\int db_{k} h_{k,l} b_{k} f(h_{k,l},H_{k,l}^{s},b_{k},B_{k}^{s})}{H_{k,l}^{s}B_{k}^{s}}$$

(Approximation of Least Square Error Weighting Coefficient)

Paragraph beginning at Page 34, line 6

On the other hand, at the weighting coefficient calculating module 902, the SIR of the I channel and the Q channel are respectively determined by the SIR measuring portion 913. The SIR measuring portion 913 is the same as the SIR measuring portion [602] 631

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shown in Fig. 7, and determines the SIR of each channel using the same method. The probability density calculating portion 914 which follows is also basically the same as the probability density calculating portion 632 shown in Fig. 7, and determines the probability density functions f_{ϑ}, $f_{\varphi I}$, $f_{\varphi Q}$ and f_{π} using the above-given Equations 36 and 37.

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Mark-up of Claims

10. (Amended) An interference canceller unit in a subtractive interference canceller for digital radio communications wherein the communication channel is composed of pilot bits, other control bits and data bits; comprising

adding means for receiving and adding an interference cancellation residual signal and a replica signal from a previous stage;

despreading means for despreading the aforementioned addition signal by multiplying a spreading code of the user;

correcting means for determining a fading vector and performing transmission path correction;

tentative decision means for deciding on a symbol from the transmission path corrected signal;

weighting means for multiplying a weighting coefficient to the tentative decision symbol;

spreading means for respreading the tentative decision symbol by multiplying the spreading code of the user; and

decorrecting means for determining a replica signal by multiplying [the inverse of] the transmission path properties to the respread signal; and

wherein said weighting means outputs a weighting coefficient $\lambda_A{}^Q$ of the pilots bits, a weighting coefficient $\lambda_B{}^Q$ of the other control bits and a weighting coefficient λ^I of the data bits as separately derived values.

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13. (Amended) An interference canceller unit in a subtractive interference canceller for digital radio communications, comprising

adding means for receiving and adding an interference cancellation residual signal and a replica signal from a previous stage;

despreading means for despreading the aforementioned addition signal by multiplying a spreading code of the user;

correcting means for determining a fading vector and performing transmission path correction;

tentative decision means for deciding on a symbol from the transmission path corrected signal;

weighting means for multiplying a weighting coefficient to the tentative decision symbol;

spreading means for respreading the tentative decision symbol by multiplying the spreading code of the user; and

decorrecting means for determining a replica signal by multiplying [the inverse of] the transmission path properties to the respread signal; and

wherein said weighting means determines a complex weighting coefficient such as to minimize the power of the interference cancellation residual signal for each channel in each stage.

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20. (Amended) A serial subtractive interference canceller comprising a plurality of stages composed of a plurality of interference canceller units for handling a plurality of users; wherein

a replica signal is prepared by inputting a received signal and a zero value to the interference canceller unit of the first user in the first stage and outputted to the interference canceller unit of the corresponding user in the next stage, and the replica signal is subtracted from the received signal and the result is outputted to the interference canceller unit of the second user;

a replica signal is prepared by inputting a signal subtracting replica signals from the first through previous users from the received signal and a zero value to the interference canceller unit of the second and subsequent users of the first stage, outputted to the interference canceller unit of the corresponding user in the next stage, and the replica signal is subtracted from the [received signal] sum of the two inputted signals and the result outputted to the interference canceller unit of the next user;

a replica signal is prepared by inputting an interference cancellation residual signal of the first stage instead of the received signal and the replica signal from the previous stage instead of a zero value to the interference canceller unit of the first user in the second stage, and outputted to the interference canceller unit of the corresponding user in the next stage, and the replica signal is subtracted from the [received signal] sum of the two inputted signals and the result outputted to the interference canceller unit of the second user; and

a replica signal is prepared and outputted by performing the same procedure until the final stage; and

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wherein the interference canceller unit of claim 10 is used.

24. (Amended) A serial subtractive interference canceller comprising a plurality of stages composed of a plurality of interference canceller units for handling a plurality of users; wherein

a replica signal is prepared by inputting a received signal and a zero value to the interference canceller unit of the first user in the first stage and outputted to the interference canceller unit of the corresponding user in the next stage, and the replica signal is subtracted from the received signal and the result is outputted to the interference canceller unit of the second user;

a replica signal is prepared by inputting a signal subtracting replica signals from the first through previous users from the received signal and a zero value to the interference canceller unit of the second and subsequent users of the first stage, outputted to the interference canceller unit of the corresponding user in the next stage, and the replica signal is subtracted from the [received signal] <u>sum of the two inputted signals</u> and the result outputted to the interference canceller unit of the next user;

a replica signal is prepared by inputting an interference cancellation residual signal of the first stage instead of the received signal and the replica signal from the previous stage instead of a zero value to the interference canceller unit of the first user in the second stage, and outputted to the interference canceller unit of the corresponding user in the next stage, and the replica signal is subtracted from the [received signal] <u>sum of the two inputted signals</u> and the result outputted to the interference canceller unit of the second user; and

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a replica signal is prepared and outputted by performing the same procedure until the final stage; and

wherein the interference canceller unit of claim 13 is used.